

Management of chest trauma; tube thoracostomy: A feasible option

Tube thoracostomy: A feasible option

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Abstract

Aim: In this study, we aimed to determine the safety and feasibility of tube thoracostomy in the management of chest trauma and its impact on patient outcomes.

Material and Methods: This retrospective study was conducted at the Department of Surgery, Northern Medical Tower, in Arar Kingdom of Saudi Arabia for 2 years from January 2019 to December 2020. Inclusion criteria were patients who presented to the Emergency Department with chest trauma due to a motor car accident (MCA), history of falls, history of assault, etc., and they were hemodynamically stable. Exclusion criteria were hemodynamically unstable patients with obvious signs of thoracotomy. Records of all patients with chest trauma were retrieved from files. The variables of the study were the demographic data, the mechanism of trauma, the clinical assessment of patients, the duration of the chest tube, length of stay in the hospital, complications, and clinical outcomes.

Result: This study included 365 patients with chest trauma, 329 (90.14 %) males and 36 (9.86%) females with a ratio of M 9:1 F. The age of the patients ranged from 12 to 70 years with a mean age of (41.15 ± 1.5) years. Road traffic accidents were the commonest mechanism in 300 (82.19%) patients with blunt chest trauma and a stab wound in penetrating chest trauma. Head and neck injuries were the most common associated injuries. Tube thoracostomy under local anesthesia was done in 98 (27%) patients, while 267 (73%) patients were managed conservatively.

Discussion: Tube thoracostomy is a safe and feasible option in the management of chest trauma with better patient outcomes. Chest trauma resulting from road traffic accidents remains the major mechanism of chest injury among young males and active age groups.

Keywords

Chest Trauma, Rib Fracture, Tube Thoracostomy, Pneumothorax, Hemothorax

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This study was approved by the Ethics Committee of Northern Border University (Date: 2020-10-20, No: 10/42/H)

Introduction

Trauma is an important and serious problem of public health concern. As the population of KSA is relatively young, injuries have serious implications for the country's health and prosperity; 40% of the population is 19 years old and younger [1]. The high motorization rate in Middle Eastern countries has increased the incidence of RTA-related fatalities [2]. Chest trauma is a leading cause of death in 25% of multiple trauma patients and, the percentage increases to 50% when associated with other injuries. [3]. Regardless of the mechanism, the main concerns of thoracic trauma are combined effects on both respiratory and cardiovascular functions, leading to hypoxia, hypovolemia, and decreased cardiac output through direct effects on the thoracic organs. [4] Most of these trauma patients are treated successfully conservatively in the emergency department through principles of initial trauma management (Advance trauma life support) and interventions such as intubation, ventilation, or intercostal tube drainage within the scope of practice of emergency physicians, while some patients with blunt chest trauma 10–15% and in penetrating chest trauma 15–30% underwent surgery. Moreover, to achieve optimal patient outcomes and significantly reduce morbidity and mortality, patients require aggressive management of chest injuries along with precise treatment of associated injuries. [5] The objective of this study was to determine the safety and feasibility of tube thoracostomy in the management of Chest trauma and its impact on patient outcomes.

Material and Methods

This retrospective study was conducted with 365 patients who presented to the ER department with chest trauma due to a motor car accident (RTA), a history of fall or assault admitted in Northern Medical Tower, during the period of 2 years from January 2019 to December 2020. Ethical approval was obtained from the institutional Local Committee of Bioethics (letter No. 10/42/H dated 20/10/2020). All hemodynamically stable patients with chest trauma irrespective of their age and sex were included in this study and hemodynamically unstable patients with obvious indications for thoracotomy were excluded from the study.

Records of all the patients with chest trauma admitted to the surgical department were retrieved from files in the medical records department, and the findings were recorded. The files concerned the medical history and clinical examination that was done on the patient at the time of arrival. Each of the patients in the department of accident and emergency had been resuscitated according to the latest guidelines of the Advanced trauma life support (ATLS) protocol, using integrated management by a team of specialists, including a trauma physician, general surgeon, orthopedic surgeon, and anesthetist. The patient had been subjected to a chest X- posterior-anterior view and a CT scan of the chest was done whenever indicated. Patients were also subjected to extended FAST scans, including the scan of the chest to detect hemothorax. Associated injuries to other parts of the body were also recorded from medical files. Management was recorded in the form of conservative treatment, analgesia, chest physiotherapy, tube thoracostomy, or thoracotomy. Study variables were demographic data,

mechanism of trauma, clinical assessment of patients, the duration of chest tube, length of hospital stay, complications, and clinical outcomes.

Data collected were entered in a master chart and analyzed using Excel-2019 with the help of a medical statistician. Data were summarized in the form of proportions and frequency tables in an Excel -2019 spreadsheet.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

This study included 365 patients with chest trauma, among them 348 patients (95.5%) had blunt chest trauma, while 17 patients (4.5%) had penetrating chest trauma. Of 365 patients, 329 (90.14%) were males and 36 (9.86%) were females. Male: female ratio was observed to be 9:1. The maximum number of patients aged 21-40 years comprised 63% (230 out of 365). Young males are more prone to chest injuries due to more exposure to the external environment.

In this study, blunt chest trauma was more common than penetrating trauma with a ratio of 10:1. Of 348 patients who had blunt chest trauma, 312 (89.65%) were males, while 36 (10.4%) were female, and all 17 patients who had penetrating trauma were males, showing that males are more prone to both blunt as well as penetrating chest trauma. Road traffic accident RTA (82.19%) is the most common mechanism of blunt chest injury, followed by fall from a height (6%), whereas stab wound was the most common cause of penetrating trauma. Moreover, pedestrians are more susceptible to blunt trauma chest as a result of road traffic accidents compared to passengers (Table 1).

Rib fractures were the most common injury 237 in patients (64.93%) after blunt chest trauma. Secondly, the lung was injured in a significant number of cases, leading to pneumothorax in 115 (31.5%) (Figure 1), hemothorax in 80 (21.91%) (Figure 2), hemopneumothorax in 65(17.80%) and lung contusion in 38 (10.41%) (Table 2).

Among chest trauma patients, the most commonly associated injuries were head and neck injuries (45.25%), followed by musculoskeletal injuries in 21.35% i.e. clavicle fracture, upper and lower limb injuries, abdominal injuries in 11.23% and spine injury in 4.52% of patients.

Pain is the chief complaint of 348 (95.34%) patients with chest trauma, followed by complaints of breathlessness in 292 (80%) as a result of respiratory distress due to pneumothorax or hemothorax. The most common clinical finding in patients with chest trauma was tenderness in 310 (84.93%) within the injury site, decreased breath sounds in 275, (75.34%), and surgical emphysema in 36 (9.86%) patients.

In the present study, tube thoracotomy was performed only in 98 (26.84%) patients, while 267(73.16%) patients were managed conservatively in the form of NSAID, epidural and intravenous narcotics, controlled analgesia (PCA), intercostal block and chest physiotherapy (Table 3).

In this study, the maximum number of patients (43.5%) had a chest tube for a period of 6-8 days and the average duration of hospital stay was 8.5 days. No mortality was found in penetrating trauma patients, whereas six blunt chest trauma

Table 1. Distribution of patients according to the mechanism of blunt chest trauma.

Cause	Number of Patients	Percentage (%)
Road traffic accidents (RTA)	300	
Pedestrian	70	82.19%
Driver	150	
Front seat passenger	80	
Fall from height	22	6.02 %
Fall of another blunt object on the chest	18	4.93%
Assault	11	3.01%
Industrial accident	8	2.19%
Hit by an animal /camel	6	1.64%
Total	365	100

Table 2. Distributions of patients according to extent of underlying damage.

Type of chest injury	Number of patients	Percentage (%)
Rib fracture	237	82.19%
Pneumothorax	115	31.5%
Hemothorax	80	21.91%
Hemopneumothorax	65	17.80%
Lung contusion	38	10.41%
Subcutaneous Emphysema	36	9.86%
Flail chest	4	1.90%
Fracture sternum	3	1.42%
Diaphragmatic Injury	1	0.47%

Table 3. Distribution of patients according to the modality of treatment (n= 365).

Modality of treatment	Number of patients	Percentage(%)
Tube thoracostomy	98	26.84%
Conservative	267	73.16%
Thoracotomy	3	0.84%
Laparotomy		
Abdominal injury	2	0.54%
Diaphragmatic injury		
Total	365	100%

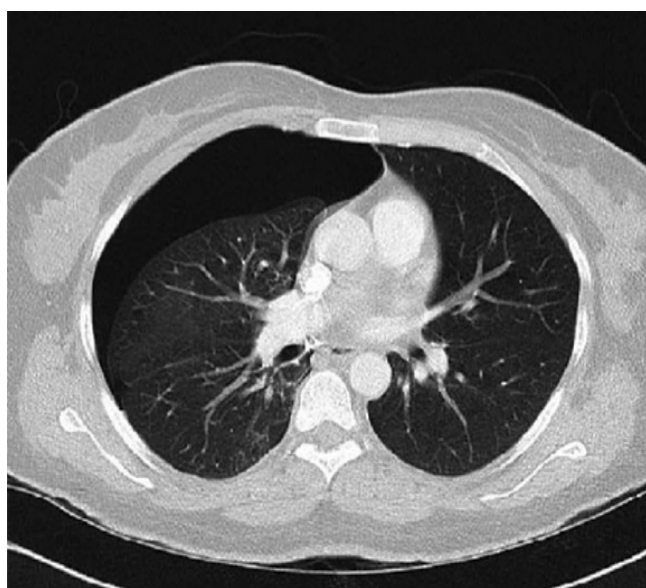


Figure 1. Right-sided-pneumothorax on Chest CT.



Figure 2. Right-sided hemothorax on Chest CT.

patients died, with a mortality rate of 1.64%; five of these deaths were associated with traumatic brain injury.

Discussion

With the rapid development of cities, expansion, and a remarkable increase in high-speed traffic flow, trauma in general and chest trauma, in particular, are increasing. Thus, the requirement for enhanced care, trained personnel, and sophisticated equipment for saving the life of trauma patients has increased [6]. A flail chest is a consequence of blunt chest trauma in which at least three consecutive ribs are fractured in two or more places and is associated with significant morbidity and mortality [7]. Surgical rib fixation (SRF) is a treatment for flail chest as it provides chest wall stability, a significant decrease in mechanical ventilation requirements, and prevents ventilator-acquired pneumonia [8]. In the present study, 4 cases of flail chest were observed; they required surgical rib fixation and mechanical ventilation for a short time. A study by Marasco et al. [9] reported that patients who received surgical treatment had significantly fewer days of mechanical ventilation and a shorter hospital and ICU-(LOS) length of stay. In the present study, the majority of patients belonged to the age group of 21-40 years, which comprised 230 patients (63.01%). Other studies by Lema et al. [10] and Khursheed SQ et al [11] also showed similar results. Our study showed a male predominance with the incidence of 90.14% and male to female ratio was 9:1. In another study by Dehgan et al. [12], they reported a male-to-female ratio of 3.34:1.7. Similar results obtained by Ekpe EE et al. [13] suggest that males and younger individuals are more likely to have more chest injuries because

they are more active and mobile, which increases the risk of trauma.

In our study, 300 patients (82.19%) suffered blunt chest trauma due to road traffic accidents (RTA), which is the most common mechanism of trauma. Similar results were reported in other studies by Lema et al (81.75%), Khursheed SQ et al (91.25%) and Aymen et al (81.25%) [14]. In this study 17 patients (4.65%) suffered penetrating chest trauma by stab wound, which is the most common mechanism of injury, but in a study by Khursheed SQ et al., gunshot injury (64.28%) was the most common cause of penetrating injury, followed by stab wound injury (21.43%). The mechanism of penetrating chest injury depends on the level of civilization of crime and violence in a particular community. In the present study, the most commonly associated injury in chest trauma patients was head injury (45.25%), followed by skeletal injury (21.35%) i.e. clavicle fracture, upper and lower limb injuries, spine injury, and abdominal injury. In a study of 52 patients by Choudhary et al. 38.4% cases of head injury and 15 % cases of skeletal injuries. were reported [15].

In this study, rib fracture was the most common type of chest injury (63 %), followed by lung injury in a significant number of cases, leading to pneumothorax in 115 (31.5%), hemothorax in 80 (21.9%), hemothorax in 18%, and lung contusion was observed in 38 (10.41%) cases. In the present study, pain and tenderness in the chest wall (95. %) were the commonest finding followed by difficulty in breathing (80.2%) as a result of pneumothorax or hemothorax. Similar results were reported in a study by Khursheed SQ et al [11].

In this study, the majority of patients 267 (73.16%) were managed conservatively with observation, adequate analgesia, intravenous narcotics, epidural analgesia, monitoring, bed rest, and chest physiotherapy, while 98 patients (26.84%) underwent tube thoracostomy with no major complications. Similar results in a study by Majid al M [16] et al., in which 170 of the 226 patients (75.2%) were managed conservatively and 57 (25.2%) of the patients underwent tube thoracostomy. Most patients with chest trauma were treated with conservative management in a study by Sharma K et al. [17] (93.6%), but studies by Khan et al. [18] and Dalal et al. [19] reported that 65% of patients 90% patients with chest injuries were managed by tube thoracostomy, respectively.

In this study, we used a large-bore chest tube (36-40 Fr) in the case of hemothorax and a small bore (28 -32 Fr) in the case of pneumothorax with fewer complications. A prospective study by Inaba et al. [20] compared the outcomes of patients treated with (relatively) small bore (28–32 Fr) chest tube versus a large bore (36–40 Fr) for trauma; authors did not find differences in terms of chest tube output and associated complication [21]. In our study a maximum number of patients (45%) had chest tubes kept for 6-8 days and the average duration of hospital stay was 8.5 days. Similar results were found in a study by Novakov et al. [22], they reported a mean hospital stay duration of 8.7 days in 212 patients with chest trauma. No mortality was found in penetrating trauma patients, whereas six blunt trauma patients died, with a mortality rate of 1.72%; five of these deaths were associated with traumatic brain injury, while in another study by Mohamed L et al. [23] the mortality rate was 6.9%.

Most of the patients with mild or minor hemo/pneumothorax

resolve spontaneously without exposing the patient to the risks associated with chest tube placement. However, a chest tube is compulsory for patients in respiratory distress on presentation, patients who require intermittent positive pressure Ventilation (IPPV), patients with associated significant injuries, and patients who develop respiratory distress during conservative management.

Conclusion

Chest trauma resulting from road traffic accidents remains the major mechanism of chest injury among young males and active age groups. Thoracic trauma is an important cause of hospitalization, morbidity, and mortality. The incidence of chest trauma was higher in males than in females. Intensive care unit stay was significantly longer among patients with blunt chest trauma than with penetrating trauma.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

The authors declare no conflict of interest.

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